In the Abstract

Please replace the Abstract with the substitute Abstract as amended below

~~The invention provides systems~~ Apparatus and methods for ~~enabling~~ high fidelity quantum communication over long communication channels even in the presence of significant loss in the channels are disclosed. The invention employs ~~comprising~~ laser manipulation of quantum correlated atomic ensembles using linear optic components ~~(110, 120)~~, optical sources of low intensity pulses ~~(10)~~, beam splitters ~~(150)~~, and single-photon detectors ~~(180, 190)~~ requiring only moderate efficiencies. The invention provides fault-tolerant entanglement generation~~,~~ and connection, using a sequence of steps that each provide built-in entanglement purification and that are each resilient to the realistic noise. The invention relies upon collective excitation in atomic ensembles rather than single particle excitations in atomic ensembles ~~and result in~~ so that communication efficiency ~~scaling~~ scales polynomially with the total length of a communication channel.